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PRACTICAL ZOOLOGY FOR BEGINNERS.

Leitfaden für das zoologische Praktikum. Von Dr. Willy Kükenthal. Zweite, umgearbeitete Auflage. Pp. viii + 304; 169 illustrations. (Jena: Fischer, 1901.) Price 7 mk.

THE character of a work on practical zoology for beginners will differ fundamentally according to the particular point of view of the author. If the attainment of a thorough grasp of the organisation of a few animals be held to be the best means of developing the capabilities of a beginner, we are naturally led to the type-system of which Huxley was the pioneer, and his "Practical Biology," used conjointly with Prof. Howes' biological atlas, will remain a classic.

The German school, on the contrary, has developed another system; it gives the beginner at once a general outline of the animal kingdom, and concurrently a large number of animals are superficially examined.

There are arguments that can be advanced for either system. The broad outline of the animal kingdom provided by the German laboratories tends to arouse the interest of the student, and it is undoubtedly worth while to sacrifice much to accomplish this end; for without intelligent interest very little need be expected from the pupil. On the other hand, it must be admitted that such a system of instruction can too readily degenerate, and the result on the student's mind is likely to be but a confused assemblage of ill-digested facts. It may well be doubted whether a cursory glance over the whole animal kingdom constitutes as valuable a training for the future investigator as a thorough study of a few well-selected types.

In our universities we have to satisfy the needs of three classes of students:—(1) those seeking a general scientific education, (2) the future investigator and specialist in zoology, (3) the future medical man. The endeavour to deal with all three classes of students in the same manner cannot be wholly satisfactory; but a student beginning the study of zoology will probably not at first have the intention of becoming an investigator, and it would in practice be very difficult, or impossible, to separate the first two classes of students. Accordingly we must be content with arranging separate courses for the general student and the medical student.

The work by Dr. Kükenthal is primarily intended as a practical aid in the laboratory for the general student beginning his subject. The opinion as to how far the author has succeeded in his difficult task will greatly depend on the particular bias of the individual teacher. That the book has had a certain measure of success in Germany is evinced by the fact that the first edition appeared only three years ago.

The book begins with a rather meagre account of the apparatus required and of the general manipulation of the microscope. The body of the work consists of twenty chapters, each of which is divided into three parts:—(1) practical instruction in manipulation and the material required, (2) an outline sketch on the subject of the chapter, (3) a special description of one or more types.

The first chapter deals with the elements of histology. In the outline sketch, the nature of a cell and the general characters of tissues are shortly described. In the special description an amœba, white blood-corpuscle of the frog, egg of mussel and examples of the various tissues are very briefly introduced. The fact that a nucleus is capable of dividing is only just mentioned, although surely even a beginner ought to be shown preparations illustrating karyokinesis.

Each of the remaining chapters deals with one group or several allied groups of animals, and at the beginning of every phylum there is given a descriptive classification. The chapter on the Protozoa begins with an excellent account of events taking place in a hay-infusion, then in a single page the general characters of the group are summarised, while in the special description of types we find representatives of most of the more important classes of Protozoa; but the Foraminifera and Sporozoa are omitted. The Hydrozoa are also dealt with satisfactorily; the special descriptions include the following instructive series:—Hydra, Tubularia, Cordylophora, Clava, Tiara, Obelia, Liriope, Aurelia and Nausithoë.

The difficulty of such comparative treatment increases greatly as we pass to the more complicated Metazoa, and the author's accounts of the various groups tend to be decidedly unequal. Thus there is a brief description of the groups Bryozoa and Chætognatha, and among the Mollusca the genera Chiton and Sepia are included; yet of the Crustacea there is only Daphnia and a rather inadequate account of the crayfish. Also, in a book of this character the student might surely be somewhat further introduced to such larval forms as Trochosphere, Nauplius and Pluteus than by the mere mention of their names.

The chapters on the Vertebrata are the least satisfactory of the book. In some seventy pages we find Amphioxus, perch, frog, lizard, pigeon and rabbit. It may be doubted whether such an abridged account could be of much use to the beginner, and the descriptions take more after the method of a text-book than of a practical guide for the student in the laboratory. Inserted here and there are a few directions as to dissection, but without the constant aid of a demonstrator it is certain that an ordinary student could make but little of them. There are practically no figures of the vertebrate skeleton, blood-systems or nerves.

With the exception of the vertebrate section, the book is well illustrated with good figures, which appear in most cases to have been selected with much care. The appearance of one incorrect figure may be noticed. The series of diagrams after Boas (Fig. 38) showing the supposed stages in the degeneration of the medusa into a sporosac do not correspond to facts. The sporosac represents the degeneration of the whole of the medusa, and is not simply the persistent manubrium. There are a considerable number of original sketches which bear the impress of being drawn directly from dissected specimen, and are consequently especially useful to the student. The original drawings of the star-fish and sea-urchin deserve particular mention.

In the opinion of the reviewer, we are in need of a compromise between the English and German methods of dealing with the beginner, in fact, a work intermediate in character between Huxley's "Practical Biology" and

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the present book. Such a work need not necessarily greatly exceed the "Leitfaden" in bulk, for the classifications, excellent though they are, and the general summary of the different groups might safely be left to the lecturer or text-book. This, together with the omission of some of the less important groups, would allow space for more practical instruction in manipulation and for a somewhat fuller treatment of most of the different types described, more especially of those of the vertebrates.

On the whole, it may be said that the present work bears the stamp of originality; the style is clear and the descriptions are terse and generally accurate, and if in a future edition Dr. Kükenthal should see fit to remodel his book in such a manner as suggested, it would be welcomed in our colleges as a valuable and much-needed aid to the beginner in the laboratory. E. W.

FERMENTS AND FERMENTATION.

Ferments and their Actions. By Carl Oppenheimer, M.D., Ph.D., and translated and amended by C. Ainsworth Mitchell, B.A., F.I.C. Pp. xii + 343. (London: C. Griffin and Co., Ltd., 1901.) Price 7*s.* 6*d.* net.

THERE are few subjects more interesting and at the same time more difficult than the study of ferments and their actions. But many students, and not a few original workers, shrink from the study of ferments owing to the great complexity of the subject. A book, therefore, which aims at treating the subject in a concise and intelligible manner must inevitably attract a wide class of readers.

The author very properly points out that it is impossible to understand any of the problems relating to fermentation unless there be formulated some definition of a ferment *per se* and some simple conception of the process of fermentation. With this object, in the second chapter the writer gives us what he considers a simple definition of the notion ferment:—

"A ferment is the material substratum of a peculiar form of energy, which is produced by living cells and adheres more or less firmly to them without having its activity bound up with the vital process as such; this energy is in a condition to bring about the liberation of latent (potential) energy of chemical substances and its conversion into kinetic energy (heat, light), in such manner that the chemical substance is so changed in the process that the new substance or the sum of the new substances produced possesses a smaller potential energy (*i.e.* a smaller heat of combustion) than the original substance."

It must be confessed that, however scientifically perfect this definition may seem to be, it will not impress the average reader with the idea of its simplicity. But the distinguished author goes on to elucidate the different heads of this definition, and in so doing makes clear even to the lay reader many vital points bearing on this difficult subject.

The following frank acknowledgment of the ignorance which underlies all our conceptions of the ways and means by which fermentative processes develop their activity is worth quoting in full:—

"We must simply resolve to regard fermentative actions as special phenomena of the ominous 'catalytic' processes from which their differentiation is required by the fact that they are produced by living cells. Catalytic action is nothing more than a scheme of despair under which we may group chemical reactions which, while possessing a certain similarity in their course, cannot, without further knowledge, be explained by our simple chemical theories. With the advance of our knowledge, we have naturally been able to assign many phenomena which were formerly regarded as catalytic to simpler chemical laws, so that this useful idea has undergone a considerable limitation in its applicability. At the same time we must not forget that in its essence even the theory of simple chemical decompositions and of chemical affinity is, as regards our theoretical knowledge, only one vast enigma; that we have only been much longer accustomed to deal with these conceptions as indispensable fundamental axioms without being able to approach them otherwise than metaphysically, which also holds good in a still wider sense of the conceptions of matter and force in general."

Chapter iii., on the chemical nature of ferments, is well worth the most careful perusal. It is the fault of the subject, not of the writer, that it makes stiff reading. In this chapter the author points out the uselessness of such vague expressions, which lead nowhere, as that there are in ferments "fragments of protoplasm" endowed with "residues of vital force." Gautier's dissolved cell hypothesis is very ably discussed.

The influence of external factors on the action of ferments is concisely dealt with in chapter iv., and chapter v., on the mode of action of ferments, is perhaps the most interesting in a book all of which is full of matter of absorbing interest and importance.

But it is impossible within the scope of this short review to touch on more than a fraction of the points in the work, which will repay study by both the layman and the expert in this subject.

A. C. HOUSTON.

OUR BOOK SHELF.

Civil Engineering as applied in Construction. By Leveson F. Vernon Harcourt. "Longmans' Engineering Series." Pp. xv + 624; with 368 illustrations. (London, New York and Bombay: Longmans, Green and Co., 1902.) Price 14*s.* net.

THIS book, as the author states in the preface, consists of a concise grouping together of the various branches of constructive civil engineering.

A book that attempts to deal in a single volume with the vast range of subjects embraced in civil engineering must necessarily be more in the nature of an encyclopædia than a series of treatises on the subjects dealt with; and the descriptions of the works selected as examples are, therefore, necessarily limited to as small a space as is possible for the elucidation of the various subjects, and for indicating the practice followed in the execution of constructive works; but what is given is of a thoroughly practical character, and the subjects are very fully illustrated. The author has not taken up space by dealing with theories, or by giving elaborate formulæ.

The information given has been derived to a very large extent from *Proceedings* of the Institution of Civil Engineers, of which the author gives full acknowledgment.

The book should be of great use to an engineer when called upon to deal with constructive works of a character that he has not had previous experience of, as indicating the various ways in which constructive requirements have been treated. To students of engineering it will be of value in directing attention to the principles forming the

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